

A Comparison of Two Knotted-Cord Fabrics: An Inka *Khipu* and a Costa Rican Census

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About the Author / *Jeffrey C. Splitstoser, assistant research professor of anthropology at the George Washington University and vice president of the Boundary End Archaeology Research Center, has studied ancient Andean textiles for over twenty years, having recently discovered (with Tom Dillehay, Jan Wouters, and Anna Claro) the world's earliest known use of indigo blue in a 6200-year-old cotton textile from the prehistoric site of Huaca Prieta. Splitstoser specializes in Wari khipus, colored-and-knotted-string devices that Andean peoples used to record information. He co-curated (with Juan Antonio Murro) the exhibition, Written in Knots: Undeciphered Records of Andean Life, April 2–August 18, 2019, Dumbarton Oaks, Washington, D.C. Splitstoser's research includes reproducing the khipus and textile structures he encounters: processing, spinning, and dyeing the fibers as well as growing cotton and dye plants. Splitstoser is an editor of two journals, The Research Reports on Ancient Maya Writing and Ancient America, and he is an editorial board member of The Textile Museum Journal. He was a junior fellow at Dumbarton Oaks in Washington, D.C., and he is a research associate of the Institute of Andean Studies and a Cosmos Club Scholar. Splitstoser received his PhD in anthropology from The Catholic University of America, Washington, D.C.*

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Abstract | This article presents information about two knotted-cord fabrics: one is an Inka khipu in The Textile Museum Collection (TM 2002.33.43), and the other is a late nineteenth-century census made by Indigenous people of the Talamanca region of Costa Rica, which is also discussed by Scott Palumbo et al. in this volume of *The Textile Museum Journal*. The author compares and contrasts these two objects, focusing on their formal and structural attributes including dimensions, cord structure, color, and knotting patterns. The author uses these data to infer ideas not only about how these objects were made but also about how information was recorded in them. He also considers the kinds of information the Talamanca census might contain in addition to recording a straightforward count of the Talamanca region's population. Ultimately, this article asks if the knotted-cord device from Costa Rica represents a knotted-cord tradition that might have functioned like Andean *khipus*.

Khipus remain one of the world's greatest undeciphered information systems. Consisting of colored and knotted cords, they were in use since the late eighth century, having helped administer two South American empires, the Wari and the Inka, as well as the Spanish, who depended on khipus to learn about the population, history, laws, religion, and other customs of the people living in their newly conquered empire. Yet after more than a century of scholarly activity, we still cannot understand the information encoded in these sophisticated, enigmatic knotted-cord devices.

This article will present information about two such devices: one is from Peru and is part of The Textile Museum Collection (TM 2002.33.43); the other is from Costa Rica and is in the collections of the Smithsonian Institution's National Museum of Natural History (NMNH E15438-o). The former is an Inka khipu, while the latter is a late nineteenth-century census made by Indigenous people of the Talamanca region of Costa Rica and is discussed by Scott Palumbo et al. in this volume of *The Textile Museum Journal*. This study compares and contrasts these two objects, expanding on Palumbo's article, and asks if the device from Costa Rica represents a knotted-cord tradition that might have functioned like Andean khipus.

This is the first time a khipu has been featured in *The Textile Museum Journal*, perhaps because khipus are technically fabrics and not textiles. According to Irene Emery, fabric is "the generic term for all fibrous constructions," while textiles specifically refer to woven fabrics using a warp and weft.¹ The Centre International d'Étude des Textiles Anciens also defines a textile as "A woven fabric in any fibre," where woven (as in, to weave) is defined as, "To make a textile... [on a]...loom by interlacing the warp and weft in a specific order."² Khipus are not woven; they are knotted, sometimes consisting of a single cord as in the case of modern khipus.³ Therefore, khipus might be more accurately defined as knotted fabrics consisting of one or more elements. Inka khipus typically consist of multiple pendant cords knotted to a main cord with cow hitches (also called lark's-head knots). Pendant cords frequently have subsidiary cords that are also knotted with cow hitches, and subsidiary cords can have multiple levels of subsidiaries of their own.

The Textile Museum Collection 2002.33.43

The George Washington University Museum and The Textile Museum has five Inka khipus in its collections: T-1191 and T-1198, which are part of the Cotsen

¹ Emery 1966, p. xvi.

² Monnas and Guelton 2021.

³ Hyland 2021; Mackey ms.; Mackey 1990a; Nuñez del Prado 1990.

Textile Traces Study Collection, and TM 91.508, TM 91.111, and TM 2002.33.43, which are part of The Textile Museum's collection. TM 2002.33.43, the subject of this article (fig. 1), was a gift of Charles E. Llewellyn, III in 2002 and is reportedly from coastal Peru. It is an Inka-style khipu and was likely made c. 1450–1534.

The majority of Inka khipus, including those in The Textile Museum Collection, are made almost entirely of cotton and were all likely recovered from contexts on the South Coast of Peru, where cotton was cultivated for millennia and extreme aridity created especially ideal conditions for preservation of perishable materials. Most post-Inka and modern khipus, on the other hand, were encountered from highland contexts, where camelids have been domesticated and raised for millennia, and these khipus are primarily made of camelid hair. Camelid hair is sometimes found in Inka khipus, especially when bright colors like red and yellow/gold were used, which can be difficult to achieve in cotton.

TM 2002.33.43 has 130 pendant cords, which is more than the average number of pendants found in khipus recorded in the Open Khipu Repository (OKR), which is an open-source database containing data collected from most Inka khipus.⁴ Khipus in the OKR have an average of sixty-four pendants with a median of sixty-seven and a mode of seven. TM 2002.33.43's pendant cords are all cotton, which is the norm for Inka khipu cords, about 88 percent of which are all cotton.⁵ Its main cord and *kayte*, discussed below, are made of camelid hair.

Knots

Inka pendant and subsidiary cords typically have knots tied in registers (fig. 2). These knots represent quantitative information. Inka khipu cords use a base-ten positional system, where the lowest knots—those closest to the distal end of the cord—represent ones. Each level above the ones' register represents a multiple of 10, 100, 1000, and so forth.

The number one is represented with a figure-eight knot, and numbers two through nine are tied with long knots, where the number of loops in the knot indicates the number being represented. A register without a knot represents zero. Multiples of 10, 100, 1000, etc. are represented with overhand knots. TM 2002.33.43 is remarkable because it has no knots

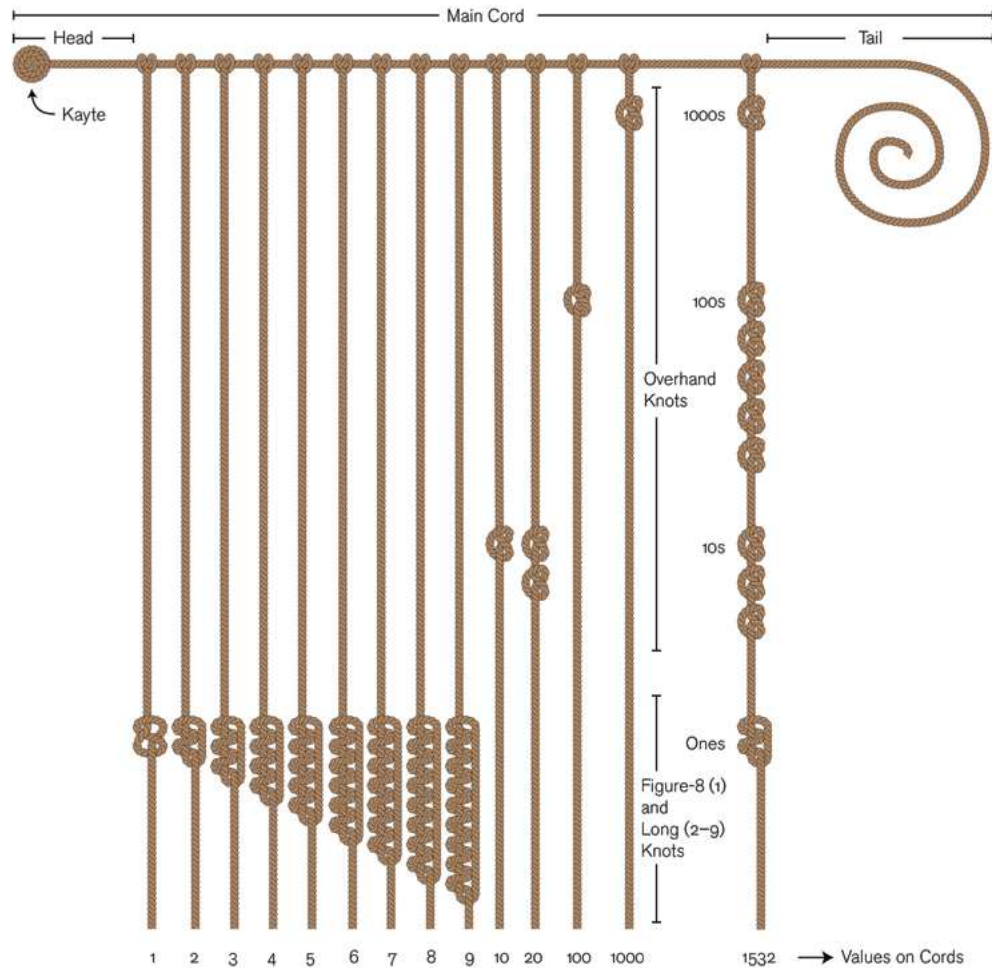


FIG. 1
Khipu. Inka, South Coast of Peru, Late Horizon, c. 1450–1534, cotton and camelid fiber, 77.15 L × 33.97 W cm (30 3/8 L × 13 3/8 W in). The Textile Museum Collection 2002.33.43, gift of Charles E. Llewellyn, III. Photography by the author.

⁴ The Open Khipu Repository database is accessible through <https://zenodo.org/record/6491290#.YtW553bMJPY>.

⁵ While the number of cords in the OKR with camelid hair in them is relatively low, Jon Clindaniel, director of the Open Khipu Research Laboratory, believes that this is probably an underestimate (personal communication, August 4, 2022).

FIG. 2
Inka base-ten, positional,
numerical knotting system.
Drawing by the author.



at all, and its cords have no bends or twists that typically appear in cords that were knotted and later unknotted, suggesting they were never tied.

TM 2002.33.43's lack of knots suggests, perhaps, that it was unfinished. This theory fits with recent discoveries made by Jon Clindaniel, who found evidence that Inka khipu cords were made ahead of time to be used later.⁶ He excavated groups of unknotted cords that were loosely attached to another cord. They would have been easily transferred to another cord, presumably a main cord, as needed. The pendant cords on TM 2002.33.43, however, are tightly attached with cow hitches (all recto) and would have required some effort to remove.

The practice of making khipu cords ahead of time to be used later, as opposed to making and knotting

them on the spot, seems to be quite ancient, starting during Late Paracas times. A group of khipu-like objects, consisting of wrapped cords that were attached to wrapped batons, were excavated from a phase 9, Late Paracas tomb (c. 350–200 BCE) at the site of Cerrillos in the Ica Valley of Peru. Unfinished cords were encountered that demonstrated that they were made while strung from a cotton cord and later transferred to a camelid-hair cord before being attached to a wooden baton.⁷

This Late Paracas practice seems to have influenced the way later Wari khipu cords were made. For example, a large Wari khipu in the collections of the American Museum of Natural History (AMNH 41.2/7678) has 125 pendant cords, all of which are wrapped with brightly colored, complex patterns

⁶ Clindaniel ms.

⁷ Splitstoser 2014.



A

(figs. 3A and 3B). Like TM 2002.33.43, AMNH 41.2/7678's pendant cords have neither knots nor subsidiary cords, and they are snugly attached with cow hitches. This khipu is associated with two other Wari khipus (AMNH 41.2/7679 and 41.2/7681), which have many pendant cords identical to those found in AMNH 41.2/7678. The author believes that AMNH 41.2/7678 may have served as a source of premade pendant cords that were transferred to the other two khipus, and AMNH 41.2/7678 has several gaps between groups of pendant cords where cords might have been removed.

Additional support for this theoretical practice comes from wrapping patterns found in many Wari pendant cords. Wari pendant cords frequently have wrapping that extends under the cow hitch, which would be impossible if the cord was wrapped while attached to the main cord (fig. 3B). For wrapping to be visible under the cord attachment, it must have been removed from one cord and reattached to another.

Another argument can be made that TM 2002.33.43's pendant cords might have been intended to serve as a source of premade cords for use in other khipus based on observations made by Andrew Hamilton regarding the making of long knots in Inka khipus. Hamilton noticed that most long knots were tied in a way that would not have been possible if they were tied while attached to a primary cord, suggesting they may have been knotted while loose.⁸

Color

Inka khipus combine quantitative information conveyed in knots with qualitative information represented

with color. Most Inka khipus have pendant cords that come in two or more colors or color patterns. Colors are usually natural shades of cotton (e.g., white, tan, brown, dark brown, and reddish brown), but dyed cotton and both natural and dyed camelid hair were also used. Cord-color patterns can be monochrome or combined to produce barber pole, mottled, or segmented (figs. 4A–4D). The last two pendant cords of TM 2002.33.43 have a faint rust-red hue and the three prior pendant cords have a faint dark blue color (fig. 5). If TM 2022.33.43's starting end with its *kayte* was depicted in figure 5, it would be on the right, making the red cords, which are on the left in the photo, the last cords on the khipu. The remainder of the khipu's pendant cords come in three hues—dark brown ($n = 60$), medium brown ($n = 52$), and mottled ($n = 13$), which consist of light brown yarns plied with dark brown yarns. The use of three colors is consistent with



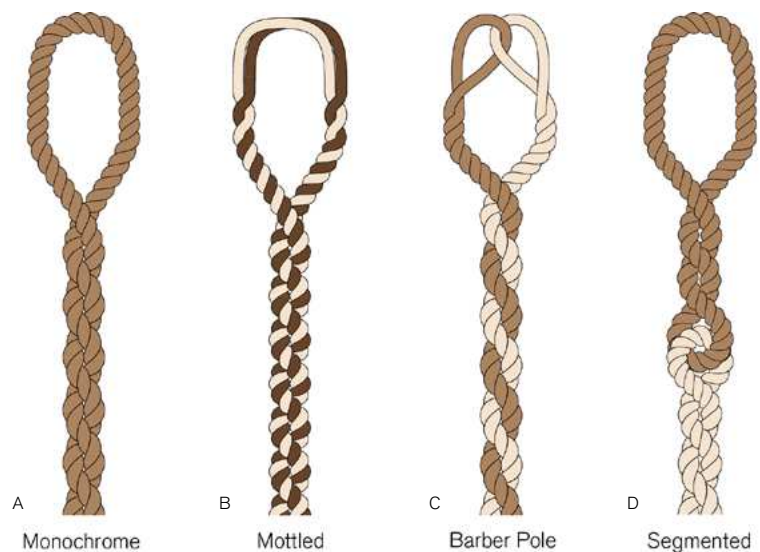
B

FIGS. 3A AND 3B

A) *Khipu*. Wari, South Coast of Peru, Middle Horizon, c. 600–1000, cotton and camelid fiber, 18 L × 113 W cm (7 1/8 L × 44 1/2 W in). American Museum of Natural History, 41.2/7678. B) Detail showing pendant cords with wrapping that extends under cow-hitch attachment knots. Courtesy of the Division of Anthropology, American Museum of Natural History; photography by the author.

FIGS. 4A–4D

Color patterns found in Inka khipus: A) Monochrome; B) Mottled; C) Barber Pole; D) Segmented. Drawings by the author.



A

Monochrome

B

Mottled

C

Barber Pole

D

Segmented

⁸ Hamilton 2016–2017, pp. 95–6.

FIG. 5
Khipu. Detail showing the last cords that are red, blue, brown, and dark brown pendant cords, cord final twist, and cow-hitch attachments. The Textile Museum Collection 2002.33.43. Photography by the author.



khipus in the OKR, which have an average number of five colors with a median of five and a mode of three. Seventy-eight percent of OKR khipus have mottled cords ($n = 482$).

TM 2002.33.43's pendant cords form thirty-five bands, where each band consists of pendants of the same color. It should be noted that, while the khipu is in excellent condition, it was sometimes difficult to distinguish between dark brown and medium brown cords. This might be due to uneven preservation while in the ground or exposure to light or other agents (e.g., liquids, oils from handling) that might have altered the khipu's colors. As a result, it was not always possible to determine precisely when one band began and another ended. Bands alternate between dark and medium hues, occasionally interrupted by mottled bands consisting of two cords. The majority of TM 2002.33.43's colored bands consist of two to five pendant cords. The largest group consists of ten cords, and there are two bands that consist of a single cord (table 1).

During the colonial period in Peru, and most likely during Inka times, banded khipus were used to record information at the level of the individual, such as the labor quota for members of a corporate group, or *ayllu*.⁹ In seriated khipus, a group of pendant cords of different colors or patterns forms a

sequence (e.g., red, green, blue, white) that repeats (i.e., rgbw, rgbw, rgbw). Seriation was used to record higher level information, such as a summary of the work obligations of a group of *ayllu* (a village) or a region, etc. TM 2002.33.43, being a banded khipu, might have represented the obligations of thirty-five individuals.

Dimensions

The khipu's dimensions, when measured by the author, are 78.5 (L) $\times$ 27.5 (W) centimeters, where the length (L) refers to the distance from the main cord to the bottom of the longest pendant cord, and the width (W) refers to the span of its pendant cords just under the main cord. The average lengths of the pendant cords found in TM 2002.33.43 are listed by color in table 2, where one can see that the average pendant-cord length is 55.1 centimeters, while a visual inspection of the khipu makes it clear that there are considerable differences in the lengths of many of its cords. Cords with reddish and blueish hues are significantly shorter, with average lengths of 28.9 and 28.3 centimeters, respectively, while dark brown, medium brown, and mottled cords are roughly the same average length: 57.2, 54.5, and 58.36 centimeters, respectively. The longest cord, a mottled cord, is 77.3 centimeters, while the

⁹ Hyland 2016; Medrano and Urton 2018; Clindaniel ms.

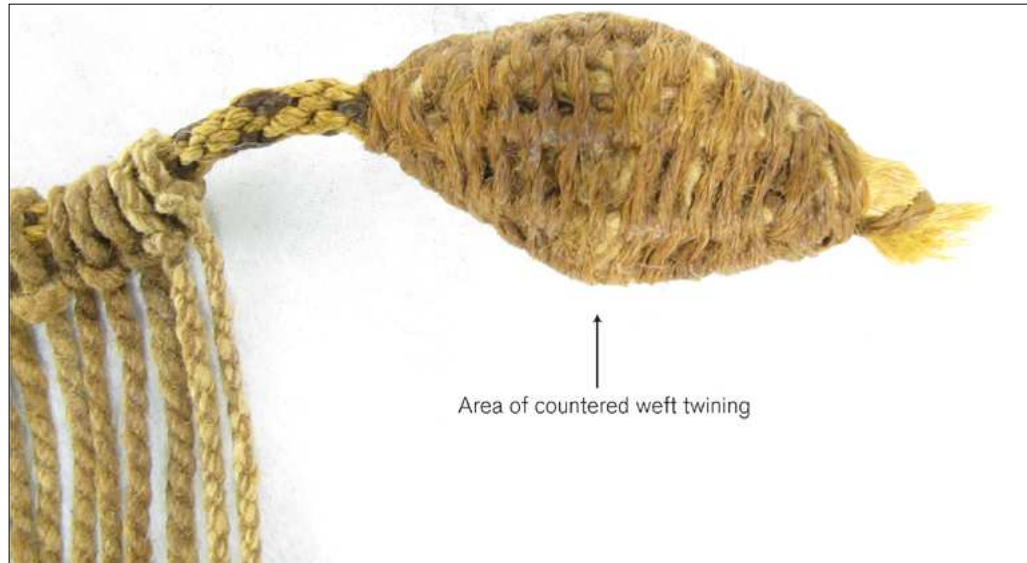
Number of Pendants per Band	Dark Brown	Medium Brown	Mottled	Rust Red	Dark Blue	Number of Bands
1	1	0	1	0	0	2
2	4	0	6	1	0	11
3	1	3	0	0	1	5
4	2	3	0	0	0	5
5	3	5	0	0	0	8
6	1	1	0	0	0	2
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	1	0	0	0	0	1
10	1	0	0	0	0	1

TABLE 1
TM 2002.33.43. Number of pendant cords per band grouped by band color.

Pendant-Cord Structure	Average Cord Length—Dark Brown	Average Cord Length—Medium Brown	Average Cord Length—Mottled	Average Cord Length—Rust Red	Average Cord Length—Dark Blue	Average Cord Length (All Colors)
S(2z(2s(2z)))	60.2	53.7	0	0	28.3	54.8
S(2z(3s(2z)))	56.0	56.2	0	0	0	56.1
S(2z(4s(2z)))	56.6	55.0	77.3	0	0	56.3
S(2z(5s(2z)))	57.3	52.3	0	0	0	54.7
S(2z(6s(2z)))	52.1	58.5	56.7	28.9	0	52.7
S(2z(7s(2z)))	0	56.2	0	0	0	56.2
S(2z(8s(2z)))	0	57.3	0	0	0	57.3
S(2z(9s(2z)))	0	56.0	0	0	0	56.0
S(2z(?s(2z)))	66.7	55.0	0	0	0	62.8
Average Length (All Structures)	57.2	54.5	58.3	28.9	28.3	55.1

TABLE 2
TM 2002.33.43. Average pendant-cord lengths listed by color and structure.

FIG. 6
Khipu. Detail of *kayte* and main
 cord. The Textile Museum
 Collection 2002.33.43.
 Photography by the author.



shortest cords in the khipu, both 27.8 centimeters, are blue and red.

TM 2002.33.43's average pendant-cord length (55.1 centimeters) is longer than the average found in the OKR, 34.6 centimeters, which is closer to the average length of TM 2002.33.43's blue and red pendant cords. Still, TM 2002.33.43's cord lengths are otherwise well within the range of other khipu cords in the OKR, the longest of which is 121 centimeters.¹⁰

Another important khipu dimension is the length of its main cord—which is 56 centimeters including a 23-centimeter-long tail—and *kayte* (fig. 6). The length of TM 2002.33.43's main cord is consistent with the average length of other main cords in the OKR, 58.9 centimeters (median = 47.5 centimeters, mode = 56 centimeters). TM 2002.33.43's main cord is an eight-strand braid made entirely of camelid hair in two colors, very dark brown and light golden brown. Braided main cords are quite rare, appearing in only about 2 percent ($n = 5$) of all khipus in the OKR, and only 4 percent ($n = 11$) of main cords are made of camelid hair. The diameter of TM

2002.33.43's braided main cord is 0.33 centimeters, which is slightly thinner than the average braided main cord in the OKR, which is 0.55 centimeters.

Kayte

A *kayte* is a tassel-like object found in some Inka and post-Inka khipus that both marks the khipu's starting point and indicates the type of information encoded in the khipu.¹¹ TM 2002.33.43's *kayte* is made of both camelid hair and cotton (fig. 6). It was most likely planned during the initial phases of making the main cord, where the tuft of unspun, golden-yellow, camelid-hair fibers that protrude from its end may have served as the handle from which the eight-strand braid of the main cord was started (fig. 7A).¹² After the braid was finished, an S-spun, very light brown cotton cord was wrapped around the handle, which secured the tuft in place (fig. 7B).¹³ Wrapping continued to produce a lozenge shape (fig. 7C), at which point the wrapping yarn was redirected to create twelve semi-rigid ribs (fig. 7D). Both ends of the ribs were secured using $Z(2s(2z))$ ¹⁴ yarns at the bottom and $S(2z(2z))$ yarns at the top. Both elements used to secure the cotton ribs

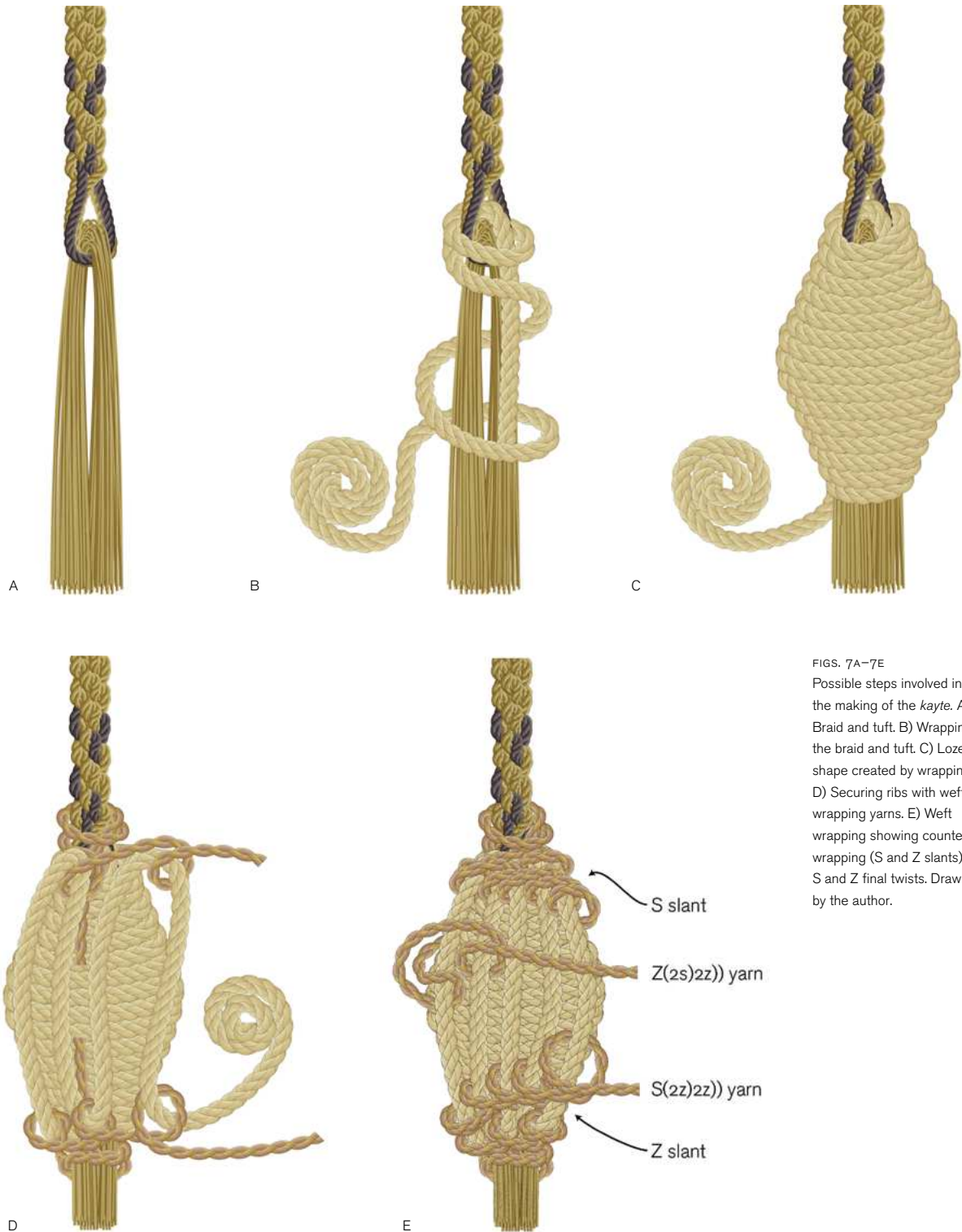
¹⁰ According to the OKR, there is one cord on a khipu from the Hacienda Ullujalla currently housed in the Ica Regional Museum in Peru, which has a length of 513.5 centimeters, but this is an outlier.

¹¹ Hyland 2021.

¹² e.g., Zorn 1982, p. 49.

¹³ Because the *kayte* is in such excellent condition, it was not possible to determine its internal structure with certainty. The discussion of its construction is based on inference from what is visible.

¹⁴ For a discussion of the notational system used to describe yarn structure, see Splitstoser 2012.



FIGS. 7A–7E
Possible steps involved in the making of the *kayte*. A) Braid and tuft. B) Wrapping the braid and tuft. C) Lozenge shape created by wrapping. D) Securing ribs with weft-wrapping yarns. E) Weft wrapping showing countered wrapping (S and Z slants) and S and Z final twists. Drawings by the author.

are mottled (gold and brown) and made of camelid-hair fiber. After securing the ribs, these yarns interworked the ribs in a technique called horizontal wrapping, with the ribs serving as the vertical elements.¹⁵ The horizontal elements (i.e., the mottled, camelid-hair yarns) interwork the ribs over two and back under one (fig. 7E). Each weft yarn was interworked from one end to the center, where the upper weft spans have an S slant and the lower wefts form Z slants, meeting in the middle with a row of countered weft wrapping (fig. 6).

Similar, but not identical, kaytes can be found in other Inka khipus, including three in the Ethnological Museum in Berlin (VA 42544, VA 47122, and VA 16135). VA 42544¹⁶ and VA 47122¹⁷ have lozenge-shaped, monochrome kaytes with tufts and outer coverings made with cross-knit looping.¹⁸ VA 16135¹⁹ has a two-color (tan and black), braided, main cord ending with a round kayte covered with vertical wrapping in two colors (dark brown and tan) with color substitution,²⁰ which is a structure still used to decorate Andean slings.²¹

Cord Structure

All of TM 2002.33.43's pendant cords are fourth order, meaning they were spun, plied, replied, and replied again.²² They are all tightly twisted with an average angle of 40 degrees, and all pendant cords have a final twist of S with an initial spin of Z, which is consistent with most khipu cords in the OKR, of which approximately 74 percent have an S twist ($n = 38,725$). TM 2002.33.43's pendant cords differ from each other in the number of S(2z) yarns that were used to make them; that is, the number of S(2z) yarns that were replied and doubled. This number varies between two and nine (table 3); however, the majority of cords are built with two to six S(2z) yarns. All the cords made with more than six S(2z)

yarns are medium brown. Cord structure other than final twist is not recorded in the OKR and cannot be compared to TM 2002.33.43.

The diameter of TM 2002.33.43's pendant cords is relatively consistent. The average diameter of all 130 cords is 1.8 millimeters (table 4), while both the thinnest and the thickest pendant cords are dark brown and have diameters of 1.31 and 2.19 millimeters and structures of S(2z(2s(2z))) and S(2z(6s(2z))), respectively. Otherwise, the majority of pendant cords approximate the average diameter. The only possible exception are the three blue cords, which have an average diameter of 1.5 millimeters.

The average diameter of TM 2002.33.43's pendant cords is slightly thicker than the average diameter found in pendant cords in the OKR, 1.2 millimeters (median and mode are both 1.3 millimeters). This discrepancy, however, could be due to the method used to measure diameter, which can vary significantly from one investigator to the next. Still, the diameters found in TM 2002.33.43 are within the range of diameters found in the OKR, the thinnest of which is 0.1 millimeter, and the thickest is 3.2 millimeters.

Average cord diameter does not seem to correspond with the number of S(2z) yarns used to make a cord. In other words, cords with more S(2z) yarns are not necessarily thicker than cords made with fewer yarns. For example, dark brown S(2z(3s(2z))) and S(2z(4s(2z))) cords have average diameters of 1.9 millimeters, which is the same as S(2z(9s(2z))) cords, yet the latter are made with significantly more S(2z) yarns.

Discussion

Given the variety of pendant-cord structures found in TM 2002.33.43 combined with their consistent diameter and relatively consistent cord length, the data suggest that each pendant cord was individually

¹⁵ Emery 1966, pp. 54–5, fig. 64.

¹⁶ Ethnological Museum, Berlin n.d., VA 42544.

¹⁷ Ethnological Museum, Berlin n.d., VA 47122.

¹⁸ Emery 1966, p. 32.

¹⁹ Ethnological Museum, Berlin n.d., VA 16135.

²⁰ Emery 1966, pp. 54–5, 214, fig. 65.

²¹ Cahlander 1980, p. 9.

²² Splitstoser 2012.

Pendant-Cord Structure	Number of S(2z) Yarns	Number of Dark Brown Cords	Number of Medium Brown Cords	Number of Mottled Cords	Number of Rust Red Cords	Number of Dark Blue Cords	Total Number of Pendant Cords
S(2z(2s(2z)))	2	16	8	0	0	3	27
S(2z(3s(2z)))	3	5	7	0	0	0	12
S(2z(4s(2z)))	4	15	20	1	0	0	36
S(2z(5s(2z)))	5	11	12	0	0	0	23
S(2z(6s(2z)))	6	11	1	12	2	0	26
S(2z(7s(2z)))	7	0	1	0	0	0	1
S(2z(8s(2z)))	8	0	1	0	0	0	1
S(2z(9s(2z)))	9	0	1	0	0	0	1
S(2z(?s(2z)))	Unknown	2	1	0	0	0	3
	Total	60	52	13	2	3	130

TABLE 3

TM 2002.33.43. Number of S(2z) yarns that were plyed and replied to make pendant cords sorted by color.

Pendant-Cord Structure	Average Diameter of Dark Brown Cords (mm)	Average Diameter of Brown Cords (mm)	Average Diameter of Mottled Cords (mm)	Average Diameter of Rust Red Cords (mm)	Average Diameter of Dark Blue Cords (mm)	Average Diameter
S(2z(2s(2z)))	1.8	1.8	0	0	1.5	1.8
S(2z(3s(2z)))	1.9	1.8	0	0	0	1.9
S(2z(4s(2z)))	1.9	1.7	1.9	0	0	1.8
S(2z(5s(2z)))	1.8	1.8	0	0	0	1.8
S(2z(6s(2z)))	2.0	2.0	1.8	1.8	0	1.9
S(2z(7s(2z)))	0	1.7	0	0	0	1.7
S(2z(8s(2z)))	0	2.0	0	0	0	2.0
S(2z(9s(2z)))	0	1.9	0	0	0	1.9
S(2z(?s(2z)))	1.8	2.0	0	0	0	1.8
Total	1.9	1.8	1.8	1.8	1.53	1.8

TABLE 4

TM 2002.33.43. Average pendant-cord diameters listed by color and structure.

FIG. 8
Talamanca census. Bribri,
Talamanca region, Costa Rica,
1873–1874, sisal fiber (*Furcraea*
cabuya) (?), 136 L × 2.4 W cm
(53 1/2 L × 1 W in).
Smithsonian National Museum
of Natural History, Museum
Support Center, NMNH
E15438-0. Donated by William
Gabb, 1874. Photography by
the author.



made to approximate an ideal—a cord that was strong, thin, and long enough to be knotted. The ends of the pendant cords support this notion, because cords whose ends are not damaged clearly show that the individual S(2z) yarns were doubled, not cut, which is what would be expected if the cords were individually made as opposed to each pendant cord being cut from a longer, premade cord. This is also a consistent feature of Wari khipu cords, suggesting this practice was ancient.

In summary, TM 2002.33.43 is consistent with other Inka khipus in its structure, method of construction, pendant-cord lengths, main-cord length, colors (and number of colors), and final twist. Its consistent cord diameters and final twist belie the presence of a practiced cord maker, most likely a single person. While smooth and regular, its cords are nonetheless slightly thicker than the average (as found in the OKR), and it has more than the average number of cords, but neither attribute is outside the ranges found in the OKR. Where TM 2002.33.43 differs significantly from other khipus is its knot-free pendant cords and its main cord, which is braided and made entirely of camelid-hair with an intact kayte. Still, the khipu is consistent enough with other khipus in the OKR that it can be used as a model with which to compare it to the Bribri census of Talamanca, Costa Rica.

Smithsonian National Museum of Natural History E15438-0

This section of the article will focus on an object from Costa Rica made of knotted cords (fig. 8). It will be compared to TM 2002.33.43 to see how closely it resembles Inka khipus in its form and construction. The object was collected during an 1873–1874 exploration of the Talamanca region by American geologist William M. Gabb, who described it as a “cord census” of five districts in that region of southeastern Costa Rica.²³ Gabb donated the census to the Smithsonian Institution in 1874, and it will hereon be referred to as the Talamanca census or NMNH E15438-0.

²³ Gabb 1875, pp. 491–2.



Dimensions

NMNH E15438-o consists of thirteen knotted cords that were grouped together by lashing (wrapping) one end with another cord (fig. 9). The lashing cord has no knots. The width of NMNH E15438-o, measured at the widest part of the lashing knot, is 2.4 centimeters. Its overall length is about 136 centimeters. When analyzing NMNH E15438-o, its cords were arbitrarily assigned numbers between one and thirteen (fig. 10).

There is considerable variation in its cords' lengths. Its longest cord, cord eight, whose length was measured below the lashing knot, is approximately 120 centimeters. Palumbo determined that this cord's length is 108 centimeters, a discrepancy which is likely due to the springy nature of the sisal fiber (possibly *Furcraea cabuya*) used to make it (see Palumbo et al. this volume). Khipus of an Andean tradition sometimes referred to as *canuto* often have cords made of an unidentified leaf fiber, possibly *Agave spp.* or *Furcraea spp.*²⁴ The bendiness of these leaf-fiber cords makes them difficult to measure accurately. To help mitigate this, the author used a

soft tape measure that typically allows for accurate measurements of contoured and springy cords.

The shortest cord, cord five, is 63 centimeters. To give the reader a better idea of how the size of NMNH E15438-o compares to that of TM 2002.33.43, the second shortest cord in NMNH E15438-o, cord 2, is 74 centimeters long, which is only three centimeters shorter than the longest cord in TM 2002.33.43, which is 77.3 centimeters, making NMNH E15438-o significantly longer but narrower than TM 2002.33.43, which has 130 unknotted cords compared to the census's thirteen knotted cords. In both objects, there is clear visual variation in the lengths of their cords. The standard deviation found in NMNH E15438-o is 14 centimeters and 8.9 centimeters in TM 2002.33.43²⁵ confirming that NMNH E15438-o has more variation in the lengths of its cords.

Cord Structure

Table 5 lists the structure, number of knots, cord diameters, and other attributes for each segment of every cord in the Talamanca census. Its cord diameters are relatively inconsistent, ranging from 1.1 to 2.1

FIG. 9
Talamanca census. Detail of lashing cord and pendants. Cords with knots above the lashing cord, as well as cords that are knotted together, are indicated. Photography by the author.

FIG. 10
Talamanca census. Numbered pendant cords. Photography by the author.

²⁴ Splitstoser 2019; Milillo 2020.

²⁵ This measurement does not include the blue and red cords, which are all shorter than TM 2002.33.43's brown, dark brown, and mottled cords.

TABLE 5
NMNH E15438-o. Structure, segment number, number of knots, diameter, and length of cords. Note that cords were divided into segments, where segment one is the part of the cord above the lashing knot and not included in the table. Segments greater than two represent places where a cord's structure changed.

Cord	Cord Length (cm)	Segment	Structure	Number of Knots	Segment Diameter (mm)	Segment Length (cm)
1	87.0	2	Z(2s(2z))	83	1.9	87.0
2	74.0	2	S(4z)	88	1.9	74.0
3	104.0	2	Z(2s(2z))	94	2.1	79.0
3	104.0	3	Z(3s(2z))	2	Not Measured	1.0
3	104.0	4	Z(4s(2z))	1	Not Measured	0.5
3	104.0	5	Z(2s(2z))	12	Not Measured	1.0
3	104.0	6	Z(3s(2z))	1	Not Measured	0.5
3	104.0	7	Z(2s)	1	1.3	16.0
4	98.0	2	Z(2s(2z))	65	2.1	98.0
5	63.0	2	S(2z)	38	2.0	63.0
6	75.0	2	S(2z)	58	2.0	75.0
7	85.0	2	Z(2s(2z))	67	1.8	85.0
8	120.0	2	Z(2s)	9	1.2	10.0
8	120.0	3	S(2z)	150	1.1	110.0
9	88.0	2	S(4z)	88	1.9	88.0
10	79.0	2	S(2z)	86	1.4	79.0
11	95.0	2	S(4z)	85	1.6	95.0
12	81.0	2	Z(2s)	88	1.5	81.0
13	89.0	2	S(2z)	101	1.4	89.0

millimeters, which is somewhat thinner on average than the cord diameters found in TM 2002.33.43. A visual inspection bears this out, suggesting they were possibly made by different people or at different times, which is what one might expect if the cords were made on the spot in each district. In fact, this is exactly what Gabb reported:

I collected in each district an accurate enumeration of the population. My process was to get together several of the most intelligent and well-informed men in the district; cause them to compare notes

*and then to tie a series of knots in strings as they are accustomed to do; different kinds of knots distinguishing the sexes.*²⁶

There are six different structures found in NMNH E15438-o, which seems to support the notion that the cords were made by different people. The most common structure is S(2z), followed by Z(2s(2z)), Z(4s), and Z(2s) in that order. Most cords are second order (i.e., spun and plied), and four cords are third order. This is different from TM 2002.33.43, whose cords are all fourth order. Unlike TM 2002.33.43, both

²⁶ Gabb 1875, p. 492.

TABLE 6
NMNH E15438-o. Number of
knots per cord listed by knot
type and knot twist.

Cord	Figure 8—S	Figure 8—Z	Figure 8— ?	Overhand —S	Overhand —Z	Double Overhand	Figure- Eight + S Overhand	Square	Total
1	2	9	0	67	1	0	1	0	80
2	4	17	0	59	8	0	0	0	88
3	6	14	0	77	0	0	0	0	97
4	4	11	0	36	0	0	0	0	51
5	0	0	0	4	34	0	0	0	38
6	0	0	0	3	55	0	0	0	58
7	8	6	0	59	0	0	0	0	73
8	53	8	0	96	5	0	0	1	163
9	9	9	1	69	0	1	0	0	89
10	9	10	0	76	0	0	0	0	95
11	7	9	0	90	0	0	0	0	106
12	8	10	0	27	42	0	0	1	88
13	9	29	1	84	0	0	1	0	124
Total	119	132	2	747	145	1	2	2	1150

S and Z final twists are present in NMNH E15438-o, and some cords are constructed with Z-spun yarns, while others use S-spun yarns.

Cord structure varied not only between cords but sometimes within the same cord. For example, cords three and eight each have multiple structures. Cord three starts out with a Z(2s(2z)) structure, changing to Z(3s(2z)), then to Z(4s(2z)), then back to Z(2s(2z)), then to Z(3s(2z)) again, and finally to Z(2s) (note the initial spin in the final segment is S). Cord eight, on the other hand, starts out Z(2s) and ends as S(2z). It is difficult to understand why multiple structures are present. Perhaps the knitter ran out of cord, making it necessary to extend it, and the extension segment simply had a different structure.

On the other hand, it is possible that cord structure might have held significance in the Talamanca census

as it did in some post-Inka khipus. The use of multiple cord structures is a feature common to all known khipu traditions, in particular Wari and modern khipus. It is common, for instance, for Wari khipus to incorporate multiple orders of structure as well as S and Z spin and final twist. In post-Inka khipus, cords with different structures, initial spin, and final twist were used to convey qualitative information. For example, a modern khipu from Cutusuma, Bolivia, collected by Max Uhle, used knot and cord twist to distinguish between ewes, rams, lambs, and milking ewes.²⁷

Unfortunately, it is extremely rare to have a transcription of the informational content of a khipu²⁸ and we do not completely understand how knot twist, cord twist, and cord attachment were used to record information in most Andean khipus. To make things even more complex, there were multiple khipu genres,

²⁷ Hyland 2014; Uhle 1897.

²⁸ See, however, Mackey 2002 and Mackey ms.

each probably recording information differently.²⁹ So until we have a better understanding of the various Andean khipu traditions and how they used structure to impart meaning, any comparisons between them and the Talamanca census will remain conjectural.

NMNH E15438-o's cords have an average twist of about 20 degrees, making them less tightly twisted than TM 2002.33.43's pendant cords. This difference might be related to the type of fiber used—that is, cotton versus leaf fiber—and how those fibers were spun. A comparison with the twist of cords in canuto-type khipus might help answer this question. That being said, cord twist in NMNH E15438-o is highly variable, as can be seen in figure 10. In fact, cord five is practically untwisted in places. This pattern gives further support to the belief that different people made NMNH E15438-o's cords.

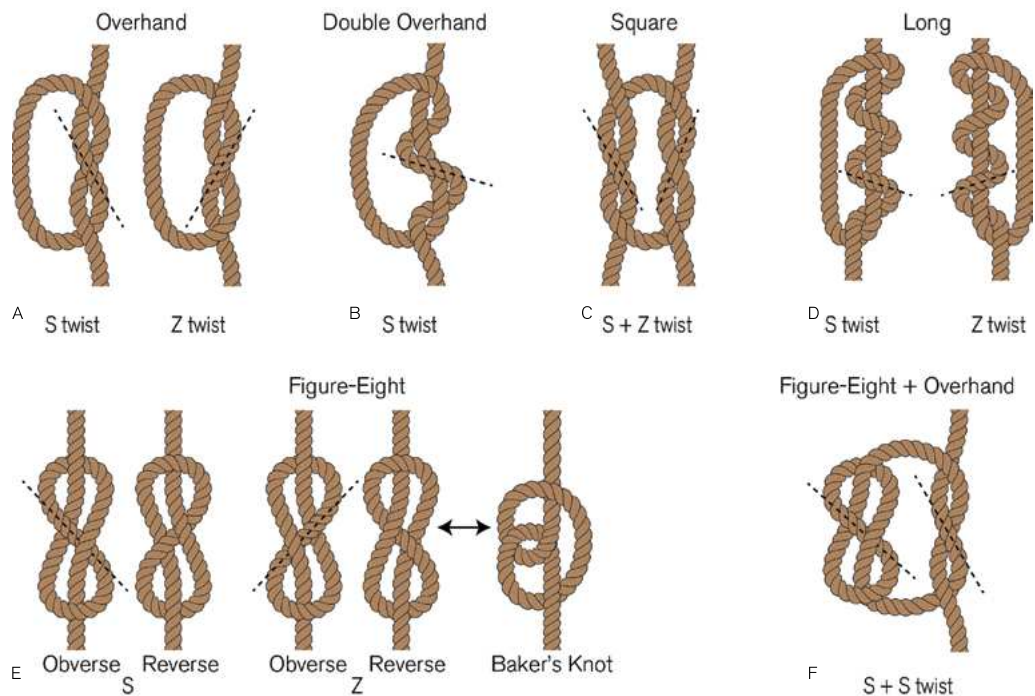
Knots

One of the biggest differences between NMNH E15438-o and TM 2002.33.43 is their knot types, or lack of them. For example, there are no cow hitches in NMNH E15438-o, and its thirteen cords are lashed together, not hitched to a main cord. Table 6

lists the number of knots per cord broken down by knot type and knot twist. A total of 1150 knots were recorded, which closely matches the 1226 people reported in Gabb's census with a difference of 76. Keep in mind that it was not possible to analyze all the knots, because some of them are under the lashing knot. Based on the length of lashing, about 3.2 centimeters, there are probably between five and ten knots per cord that could not be analyzed. If six missing knots were added to each cord, based on an average of about two knots per centimeter, there are approximately 1228 ($= 1150 + [6 \times 13]$) knots, which is two knots more than the number recorded by Gabb. This suggests there was a one-to-one correlation between knots in the census and people in the districts.

NMNH E15438-o has numerous knots tied in each of its cords. Its knots come in six different types: S-twist overhand, Z-twist overhand, square (S + Z), S figure-eight, Z figure-eight, and figure-eight + overhand (S + S) (figs. 11A–11F). In this article, knot twist is used instead of knot direction, where knot direction is the knot-notation system most commonly used by Inka khipu scholars for figure-eight and

FIGS. 11A–11F
Types of knots found in NMNH E15438-o. A) Overhand S twist (left), Z twist (right). B) Double Overhand. C) Square. D) Long: S twist (left), Z twist (right). E) Figure-Eight: S twist (left, obverse and reverse), Z twist (center, obverse and reverse), and Baker's Knot Z twist (right). F) Figure-Eight + Overhand, S + S twist. Drawings by the author.



²⁹ e.g., Brokaw 2010, pp. 96–9, 184–5.

overhand knots.³⁰ The Talamanca census, as well as Wari and modern khipus, however, have compound knots (e.g., square, double, triple) that are made by tying multiple overhand knots, each with its own knot twist. Therefore, knot-twist notation must be used instead of knot direction, because it can capture the multiple twists found in compound knots.

The majority of knots in NMNH E15438-0 are overhand knots ($n = 892$, 78 percent), and the majority of overhand knots are S twist representing 84 percent of overhand knots. The second most common knot is the figure-eight knot ($n = 253$), of which 119 (47 percent) are S. There are two knots made with an S figure-eight knot that was subsequently tied with an S-twist overhand knot. There are two square knots (both S + Z). Neither figure-eight + overhand nor square knots appear in the OKR, indicating that they probably are not found in Inka khipus; however, simple overhand and figure-eight knots are common in Inka khipus, representing multiples of ten and the number one, respectively. Because each knot in the Talamanca census likely represents an individual person, and Gabb stated that different knot types distinguished between males and females, the two traditions apparently used knots differently to record information.

Discussion

What can be inferred about the Talamanca census relying on the data presented above? Based on the number of knots found in the cords, each cord of NMNH E15438-0 may be matched with a district whose population was mentioned by Gabb,³¹ provided two assumptions are made. First, cords that are knotted to each other must also belong to the same district: cords five and six are knotted to each other, as are cords ten and thirteen (fig. 9). Second, cords, or groups of cords, whose total

number of knots is equal to, or slightly less than, the population of a district probably represent that district. These populations are provided in the Gabb census as follows: "Tiribi" (103), "Uren" (604), "Bri-bri" (172), "Cabecar" (128), and "The Valley" (219).³² Based on these assumptions, it is proposed that cords five and six represent Teribe; cords one, two, three, nine, eleven, and twelve represent Urén; cord eight represents Bribri; cords four and seven represent Cabécar; and cords ten and thirteen represent The Valley. Table 7 lists the populations of each district and a potential match between districts and cords in the Talamanca census.

Assuming these relationships between cords and districts, it is possible to look for additional information about these populations based on knot patterns found in the Talamanca census. For example, Gabb stated that "each house was counted separately,"³³ and patterns in the knots seem to bear this out. In all the cords of the census, knots are clustered into groups (knot groups) separated with spaces. In all the districts except Teribe (i.e., cords five and six, discussed below) these knot groups consist mostly of one to six (up to ten) figure-eight knots followed by a larger number of overhand knots, which can range from one to thirty-six with the majority between four and seven (fig. 12).

The average number of figure-eight knots in a knot group is three (the median and mode are also three), and the average number of overhand knots is nine, with median and mode of seven. If knot groups represented family units, the average household size (i.e., extended families living in one house) would be twelve (median and mode of ten). Some knot groups contain over thirty knots and up to forty-five. This seems reasonable given that Gabb describes the region's houses as being, "usually circular, from



FIG. 12
Talamanca census. Detail of cord twelve showing pattern of S figure-eight knot followed by Z figure-eight knot followed by six overhand knots.
Photography by the author.

³⁰ Urton 1994, pp. 276–83.

³¹ Gabb 1875, p. 492.

³² These district names are based on Gabb's 1875 census report; however, because Gabb's terminology and orthography differs from subsequent and current use in historical and anthropological writing about the area (John Hoopes, personal communication, August 5, 2022), subsequent references to these districts are as follows: "Tiribi" will be referred to as Teribe; "Bri-bri" will be Bribri; "Uren" is Urén; "Cabecar" is Cabécar; and "The Valley" will remain the same. According to Hoopes, it is not clear what Gabb meant by "The Valley" and the people to whom he is referring.

³³ Gabb 1875, p. 492.

TABLE 7
NMNH E15438-o. Populations
listed by district and their
possible respective cords.

District	Proposed Cord Number	Number of Knots	Number of Knots per District	Population Reported by Gabb
Teribe	5	38	103	103
Teribe	6	58	103	103
Urén	1	80	604	604
Urén	2	88	604	604
Urén	3	97	604	604
Urén	9	89	604	604
Urén	11	106	604	604
Urén	12	88	604	604
Bribri	8	163	172	172
Cabécar	4	51	128	128
Cabécar	7	73	128	128
The Valley	10	95	219	219
The Valley	13	124	219	219
Total	n/a	1150	1226	1226

thirty to fifty feet in diameter, and about the same in height.³⁴ John Hoopes notes that houses in the Talamanca region included large, circular, thatched *palenques* (platforms) that could accommodate many members of a specific kinship unit.³⁵ Further, Alfredo González C. and Fernando González V. note that some chiefly houses, so-called *u-suré*, were about 30 meters in diameter and were home to 60 or more individuals.³⁶ Based on this information, it is clear that at least some houses in the Talamanca region were capable of accommodating households of the sizes found in the Talamanca census, presuming knot groups represented people in a household.

As for the general distribution of knots in a knot group, it has already been noted that they begin with one or more figure-eight knots, and if it is a single figure-eight knot, it is usually Z. If more than one figure-eight knot starts the knot group, they almost

always begin with a group of one or two (up to five) S figure-eight knots that alternates with a group of one to three Z figure-eight knots, and so forth up to five times. This is found in cord twelve, which has a group of six figure-eight knots that forms a sequence of 1S-1Z-2S-1Z-1S (that is, one S knot followed by one Z knot, followed by two S knots, and so forth). Cord three has the largest group of figure-eight knots, ten, which alternate in a sequence of 1S-6Z-2S-1Z.

Almost all groups of figure-eight knots in the Talamanca census are followed by groups of overhand knots, all of which have an S twist; only three of its thirteen cords have figure-eight knots followed by Z-twist overhand knots: They are cords two, eight, and twelve. Cord two has one knot group in which eight Z-twist overhand knots follow a series of 1S-2Z figure-eight knots. It has five other knot groups that follow the typical sequence described above. Cord

³⁴ Gabb 1875, p. 514; see also p. 485.
³⁵ Personal communication, August 4, 2022.
³⁶ González Chaves and González Vásquez 1989. Thanks to Scott Palumbo for alerting the author to this reference.

twelve, the only cord that has a dark brown color,³⁷ has three knot groups in which Z-twist overhand knots follow figure-eight knots while three other knot groups follow the normal pattern.³⁸ Cord eight has five knot groups (out of sixteen) in which a single Z-twist overhand knot appears, and they are all found together near the distal end of the cord. The first four of these five knot groups consist of three to five figure-eight knots followed by a group of one to three S-twist overhand knots, which are then followed by a single Z-twist overhand knot.³⁹ In the fifth knot group, a series of six figure-eight knots (1S-1Z-2S-1Z-1S) is followed by a single Z-twist overhand knot, which in turn is followed by two S-twist overhand knots.

As mentioned above, only cords two, eight, and twelve have cord groups where Z-spun overhand knots can succeed figure-eight knots. Cords two and twelve, which likely represent populations in the largest district, Urén, might record information about a subpopulation whose makeup is unique either to Urén or the Talamanca region in general. Cord eight, which likely represents Bribri, might also record information about a unique subpopulation; however, as the only district represented by a single cord (the longest cord and the cord with the most knot groups, sixteen),⁴⁰ cord eight might also record information in a unique manner, since all the other districts use two or more cords. One possible, if speculative, explanation is that in districts with two or more cords, moieties (two social-ritual groups) could easily be represented.⁴¹ If cord eight represents moieties, however, it would have to do it using a single cord, and this might explain the two types of knot groups (i.e., one type with S-twist overhand cords, and another with both S- and Z-twist overhand cords).

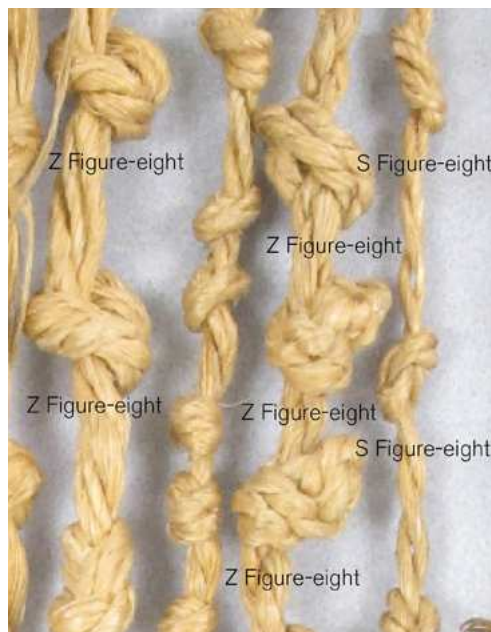


FIG. 13
Talamanca census. Detail of S figure-eight and Z figure-eight knots, where Z figure-eight knots are tied as baker's knots. Photography by the author.

As noted above, Gabb stated that sex was recorded with different knots.⁴² If sex was notated using overhand and figure-eight knots, however, then the populations would have been heavily skewed toward a single sex, because overhand knots make up 78 percent of all the knots in the Talamanca census.

If, however, overhand and figure-eight knots represented age groups and/or status, the ratio of overhand to figure-eight knots might be more understandable. Gabb, however, makes no mention of children, if they were distinguished from adults or even represented in the census at all. It is tempting to suggest that children might have been recorded with overhand knots while adults were counted with figure-eight knots; however, the ratio of children to adults would be 3.5:1, which seems extraordinarily high.⁴³ If children are represented, then the knotting system at work in the Talamanca census is more complex than it would seem.

³⁷ Cord twelve is the only cord that is medium-to-dark brown (Pantone color Teak). The other cords have a honey color (Pantone color Tiger's Eye).

³⁸ Cord twelve also has one knot group consisting of a square knot followed by eleven Z-twist overhand knots. The square knot is a repair at a break in the cord. If the repair was tied where a figure-eight knot had been, there would be four knot groups with figure-eight knots followed by Z-twist overhand knots.

³⁹ In the second through the fourth of these knot groups, the Z-twist overhand knots are followed by a group of one-to-four S-twist overhand knots.

⁴⁰ Cord thirteen, one of two cords that document The Valley, has the second highest number of knot groups: thirteen. The third highest number of knot groups is seven as found in cords seven, ten, and twelve. The majority of cords have between five and seven knot groups.

⁴¹ Scott Palumbo (personal communication, August 7, 2022), citing Henri Pittier, notes that Bribri society is organized into two broad exogamous moieties, and members of one moiety or another are affiliated with one of the dozens of clans. Pittier 1898, pp. 22–3.

⁴² Gabb 1875, p. 492.

⁴³ According to the World Bank, even in countries with the highest percent of children age 0–14, they make up less than 50 percent of their populations. Thus, the ratio of children to adults in them is less than 1:1. World Bank 2022.

48 Personal communication, August 5, 2022.

may have referred to a river drainage occupied by Bribri or Cabécar people. If Gabb's "Tiribi" refers to Naso people, this might account for the different knotting practices found in cords five and six.

Summary and Conclusions

In summary, the Talamanca census records 1226 people who were living in the Talamanca districts,⁴⁹ and 1150 knots were recorded during the author's study of NMNH E15438-o. The shortfall of seventy-six knots, however, is accounted for when including the number of knots estimated to be under its lashing cord. The study also was able to assign each of the census's thirteen cords to one of the five districts Gabb identified.

Gabb stated that the populations of each district were counted by house and that sex was distinguished by knot type, which seems to be confirmed in the way the knots form groups—figure-eight knots combined with overhand knots separated with spaces—that seem to correspond with households or other social groups. Sex seems to have been notated, at least in adults or possibly heads of households, in terms of knot twist or direction (S and Z). It seems that spaces between groups of overhand knots could have recorded additional information about the population, a subject that needs further research.

Clearly from the above discussion, NMNH E15438-o was recording information, but how did the Talamanca census function compared with Andean khipus, given that knotting practices in the two traditions seem to have differed significantly? Like Andean khipus, the Talamanca census does not represent a simple counting system like an abacus.

While its knotting patterns seem to follow a logic that differed from those found in Andean khipus, the Talamanca census nonetheless has many similarities with several Andean khipu traditions, including Wari, Inka, Canuto, and modern. It therefore can be said to represent a knotted-cord information system that, as Palumbo et al. notes in this volume, was part of a long tradition of using knotted-cord devices to record information.

It should come as no surprise that people in the Talamanca region were recording information with knots on cords, because other such systems were used elsewhere in the Americas. For example, a colored-and-knotted-cord tradition, known as *nepohualtitzin*, was used in Mesoamerica until at least the eighteenth century.⁵⁰ Puebloans used knotted cords to announce the countdown to events including the Pueblo Revolt of 1680, where knotted cords were distributed to villages, and the number of knots on the cord indicated the number of days left before the revolt. One knot was untied each day until all the knots were gone, at which time the Pueblos mobilized.⁵¹ Salish people living on the Northwest Coast of the United States and British Columbia recorded their life histories on knotted cords, where days were marked with knots, and different markers—colored beads, fiber, human hair, leather, and various other attachments—were used to mark important events.⁵²

Considering the other knotting systems that exist(ed) in the Americas, the Talamanca census seems to most closely resemble Andean khipus, mainly on account of its use of multiple kinds of knots (and spaced knot groups), its use of S and Z twist, and its use of multiple cords, cord structures, and groups of cords. With this in mind, can, or should, we call

⁴⁹ Gabb 1875, p. 492.

⁵⁰ An entry in Simeón's dictionary of Nahuatl, attributed to Clavijero, defines *nepohualtitzin* as, "*Hilos de diversos colores que, anudados de diferentes maneras, servían, como los quipos del Perú, para recordar sucesos memorables; mas esta costumbre parece no haber sido seguida por los antiguos mexicanos más que en tiempos muy remotos.*" (Siméon 2002, p. 333; Clavijero 1971, pp. 63, 74). "Threads of different colors that, knotted in different ways, served, like the quipus of Peru, to remember notable events; but this custom seems to have been followed by the ancient Mexicans only in very remote times" (translation by author). Siméon (2002, p. xviii) also notes that Lorenzo Boturini B. encountered examples of *nepohualtitzin* in Mexico in the eighteenth century, "*Boturini ha comprobado por sí mismo el uso de este método y ha declarado que después de múltiples búsquedas logró descubrir, en una localidad de la república de Tlaxcala, una muestra del instrumento nemotécnico cuyos hilos estaban ya deteriorados y casi destruidos por el tiempo.*" (Boturini Benaduci 1746; see also Locke 1923, pp. 45, 60, 63, 74). "Boturini has verified for himself the use of this method and has declared that after multiple searches he managed to discover, in a locality of the Republic of Tlaxcala, a sample of the mnemonic instrument whose threads were already deteriorated and almost destroyed by time" (translation by author).

⁵¹ See, for example Brown 2015, p. 201.

⁵² Leechman and Harrington 1921.

the Talamanca census a khipu? The Bribri once called knotted cords *tsá wö* (meaning “letters”)⁵³ and given that it seems to function like a khipu, it would seem appropriate to call it either a *tsá wö* or a Chibchan-type khipu.⁵⁴

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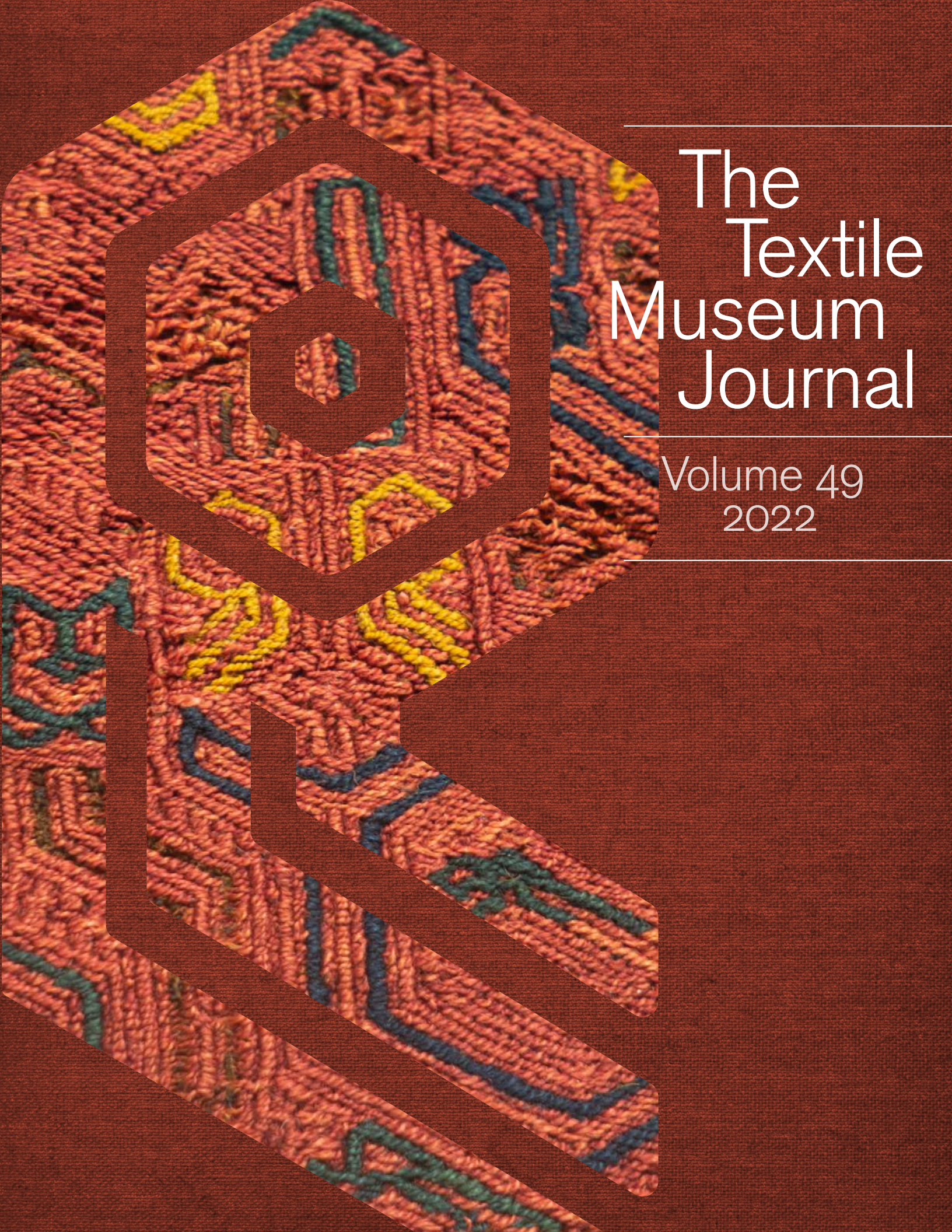
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⁵³ Rodríguez-Sánchez et al. 2020.

⁵⁴ Hoopes (personal communication, August 5, 2022) notes the Chibchan term may be appropriate here given the multiethnic nature of the participants, all of whom spoke languages in the Chibchan language family.

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